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# Socioeconomic Structures, Smoking and Obesity

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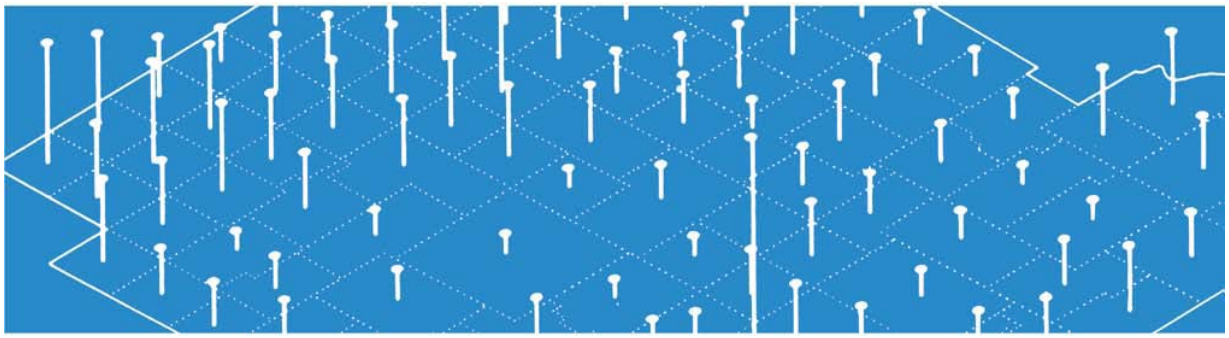

## Abstract:

Previous research has examined the relationship between socioeconomic status, demographic characteristics and the incidence of smoking and obesity. This study examines the effects of post-industrial economic structures and values on smoking and obesity. Our central hypothesis is that levels of both smoking and obesity will be lower in locations which are characterized by post-industrial structures characterized by higher shares of knowledge-based/ creative work and higher levels of education, and higher levels of post-industrial values associated with greater openness and tolerance to immigrants and to gay and lesbian populations. We test these relationships empirically across the 50 US states in statistical models that control for income, race and ethnicity and other factors that have previously been found to be associated with smoking and obesity. Our results suggest that smoking and obesity rates are significantly lower in states with higher levels of levels and higher proportions knowledge-based/creative jobs, even when we control for income or economic output measured as Gross State Product per capita. We further find that post-industrial values of openness and tolerance have a significant effect on state obesity rates, in addition to the effects of race. Overall, we find that post-industrial structures provide an important explanatory value for the distribution of smoking and obesity across the US states.

**JEL:** I1, J1, J24

**Keywords:** smoking, obesity, post-industrial structures, education, occupation, openness

## Introduction

Smoking and obesity pose significant health problems in the United States and other advanced industrial nations. Nearly one in five Americans is a smoker and one in four is obese. Smoking and obesity are associated with significantly higher rates of cardiovascular disease and of cancer which are leading causes of death in advanced economies (Murray and Lopez, 1997). Smoking is associated with increased risk for cancer, emphysema and fatal heart and lung conditions (Tjepkema, 2005). Obesity is linked to diabetes, cardiovascular disease, gallbladder disease and cancer (Rubenstein, 2005). Recent studies (Fontaine et al., 2003; Doll et al., 2004) find that smoking reduces the average life span by roughly ten years, while obesity reduces life-spans by between five and twenty years, depending on age and race. The economic costs are substantial. The Centers for Disease Control estimates that the two combined generate health costs of more than $300 billion a year (Reuters, 2009; Centers for Disease Control, 2009). Smoking and obesity are also related to each other. Rasky et al. (1996) find a relationship between heavy smoking and high BMI while Canoy et al. (2005) find that smokers have a higher waist to hip ratio than non-smokers

Previous research has examined the demographic and economic factors that influence the prevalence of smoking and obesity among individuals (Sobal and Stunkard, 1989; Bang and Kim, 2001; Zhang and Wang, 2004; Barbeau et al., 2004; McLaren, 2007). A wide range of empirical studies have found smoking and obesity to be closely associated with education, occupation, and income as well as gender, race, and ethnicity (Novotny et al., 1988; Sobal and Stunkard,1989; Ostbye et al. 1995 Barbeau et al., 2004; McLaren, 2007) . Other research has examined the variation in smoking and obesity across nations (Sobal and Stunkard, 1989; Monteiro et al., 2004; McLaren, 2007), finding significant variation by national level of development on a national level (Sobal and Stunkard, 1989; Monteiro et al., 2004; McLaren,

2007), as well as by state and region (Lynch et al., 1998; Deaton, 2003; Chaix and Chauvin, 2003; Sturm and Datar, 2005; Chang and Christakis, 2005).

*Standard of Living*

Numerous studies have found a close association with income: As incomes rise, rates of smoking and obesity decline. Research on smoking finds higher levels of smoking in lower income populations, and lower incidence across higher income populations (Feinstein, 1993; Friested et al., 2003). The same basic pattern holds for obesity. McLaren's (2007) exhaustive literature review of empirical studies of obesity cites nineteen studies which observe a negative relationship between income and obesity.

*Gender*

Gender has been found to play a big role in smoking and obesity at the individual level. Women generally speaking have been found to have lower rates of smoking (Jarvik et al., 1977; Healton et al., 2006) and lower rates of obesity (Rand and Kuldau, 1990; Healton et al. 2006) compared to men. In addition, the effects of other factors such as income, occupation and education tend to vary depending on gender—with stronger relationships observed among women than men (Jarvik et al., 1977; Sobal and Stunkard, 1989; Tjepkema, 2005; McLaren, 2007).

*Race and Ethnicity*

Race and ethnicity have also been found to be associated with smoking and obesity in a large number of studies (Ostbye et al., 1995; Tremblay et al., 2005). The risk of developing hypertension at a given level of obesity was found to be higher among blacks than among whites and Hispanics (Paeratakul et al., 2002). Smoking has also been found to vary by

ethnicity, with African Americans smoking at higher rates than whites (Centers for Disease Control, 1987; Novotny et al., 1988; Healton et al., 2006). Lung cancer and cardiovascular disease, the diseases most associated with smoking, are also more common among African Americans (Novotny et al., 1988). Healton et al. (2006) find that the co-incidence of smoking and obesity is higher in African-Americans (7 percent) than whites (5.3 percent). However, the effects of ethnicity and race appear to become weaker when other socioeconomic variables – such as income and education - are controlled for. Winkleby et al. (1995) found no racial differences in smoking among the college educated and pronounced differences among those with less than a high school education. Other studies find that race is not a significant predictor of obesity when education and income are taken into account (Logue and Jarjoura, 1990; Lillie-Blanton et al., 1996). Healton et al. (2006) and Novotny et al. (1988) also find that effect of race disappears when income is controlled for.

*Post-industrial Transformation*

A large and influential body of literature documents the transition from industrial to post-industrial economies and societies. This transformation entails the shift economies oriented around large-scale factories and blue-collar work to higher-levels of knowledge-based and creative work distinguished by higher levels of educational attainment (Machlup, 1962; Bell, 1973; Florida, 2002). Drucker (1988) long ago coined the term "knowledge worker" and Wright and Martin (1987) identified the rise of the "professional-managerial strata" as a major new category of worker. Brint (1984) finds that roughly 30 percent of the US workforce is employed in knowledge based occupations, while Florida (2002) finds that nearly a third 30 percent) of the US workforce are engaged in creative class work which spans science and technology; arts and culture; media and entertainment; business and finance; law; healthcare; and education. Economists have noted the key role played by

knowledge and (Romer, 1986) of human capital in economic growth (Lucas, 1988; Barro, 1991; Glaeser et al., 1992).

The shift to post-industrialism is also associated with the rise of new norms and social values. Ray and Anderson (2000) find that "cultural creatives" evidence higher levels of concern for the environment, gender equality and self-actualization. Astin (1998) finds that cultural creatives are more likely to supplement conventional healthcare with alternative medicine than are others. Florida (2002) finds that creative class members y value openness, meritocracy and individuality and this thus seek out places that are most conducive to these values. Inglehart (1977) observes an associated shift in values and attitudes concurrent with the rise of post-industrial economic systems, which he refers to as a shift from materialist to post-materialist social and political cultures. Industrial societies have a materialist orientation and prize economic security gained through economic growth and material wealth. Post-industrial societies are also "post-materialist" in their values and orientations which favor secularism over religion, self-expression over conformity, merit over seniority, public goods like environmental quality over interest-group redistribution, and openness and acceptance of women, minorities and gay populations.

*Overview of the Present Research*

Our research examines the effects of post-industrial socioeconomic structures on smoking and obesity. Our central argument is that the shift to post-industrial socioeconomic structures has a strong effect on smoking and obesity at the state level. More specifically, we suggest that states with higher concentrations of creative work and higher levels of educational attainment will have lower rates of smoking and obesity, which operate in addition to the effects of income and level of development. Put another way, we argue that

obesity and smoking are not merely influenced by individual-level characteristics, wealth or access to resources, but by a person's position within the socioeconomic order.

There are several mechanisms that work to mediate the relationships between post-industrial structures and smoking and obesity. The first relates to education. While smoking is a practice and obesity is a condition, each is related to unhealthy consumption. To a certain extent, smoking and obesity reflect what Giddens (1996) might call "manufactured risks"-threats that have arisen with modernity, resource development and the decline of death by natural causes. Both the research literature and commons sense suggest that individuals with higher levels of education would be more likely to be aware of the health risks posed by smoking and obesity and have the discipline required to overcome predispositions to overeat or smoke. Previous studies have found a close association between education at the individual level and smoking and obesity (Ostbye et al., 1995; McLaren, 2007; Ward et al., 2007). Rates of smoking and obesity are negatively correlated with education, meaning their rates decline as education levels increase. Almost two-thirds (65 percent) of the education and obesity studies tracked by McLaren (2007) found a negative correlation. Other studies have found that lower levels of education are associated with incrementally higher BMI values (Ostbye et al., 1995; Ward et al., 2007; Ross et al., 2007). A similar relationship has been observed for smokers (Friestad, 2003; Barbeau et al., 2004; Winkleby et al., 1995; Healton, 2006). There is also evidence that smokers with lower educational profiles absorb less smoke into their lungs than do the more educated (Bobak et al., 2000).

Second, the propensity to smoke and to be obese is associated with the kinds of work people do. Previous studies have identified a close association between occupation or type of work and smoking and obesity. McLaren (2007) found a close association between white collar occupations and lower body size. Al-Asi (2003), Barbeau et al. (2004), and Caban et al. (2005) found that smoking was significantly and positively related to blue-collar work. Bang

and Kim (2001) found that health professionals and teachers, two large categories of knowledge-based work, had some of the lowest smoking rates.

But what is the mechanism which underpins this association? Knowledge-based and creative occupations may select for healthier-oriented individuals or may encourage healthier behaviour. Conventional wisdom as well as several studies (Benson et al., 1980; Pingitore et al., 1994; Sarlio-Lahteenkorva and Lahelma, 1999) suggests that more physically fit individuals have advantages in advancement in professional careers. People in knowledge based occupations, while sedentary in the completion of work tasks, appear to be oriented to exercise and physical activity. Florida (2002) has found creative class individuals and creative class communities place a higher value on outdoor recreation, and active participation in sport and cultural activities as opposed to more passive spectator activities. This appears to be tied to the nature of knowledge-based and creative work itself, which is sedentary and requires considerable focus and concentration. Physical activity provides a form of release and also enables the mind to reset for later creative endeavor. In a major review of the literature on obesity, McLaren (2007) points the recurring findings of a negative relationship between white-collar workers and obesity, and ties this to norms of physical fitness, writing that: "…in a white-collar office environment with on-site exercise and shower facilities, it is easy to imagine social norms surrounding practices such as going to the gym during lunch hour." New norms similarly act to dissuade smoking in knowledge work environments (Florida, 2002).

We also examine the effects of diverse and tolerant environments on smoking and obesity. Several studies (Black et al., 2000; Florida and Gates, 2001; Florida, 2002) find an association between openness and diversity and higher levels of human capital and of creative occupations. Such environments have an advantage in attracting individuals from across the spectrum of gender, race, ethnicity, sexual orientation and so on. Openness and

tolerance also reflect an economic structure which values meritocracy, and in which individuals can succeed more on the basis of talent than on demographic categories. We contrast our focus on diversity and openness with the extant literature focus on gender, race and ethnicity. We propose that characteristics of open, diverse and tolerant environments – which we measure in terms of observed concentrations of immigrants and gay populations – will outperform conventional measure of gender, race and ethnicity in predicting smoking and obesity.

Our research also differs from many studies of obesity and smoking in that it focuses not on the individual level, but on the characteristics of geographic locations, that is states, that operate as socioeconomic environments to shape individual behaviour. We argue that it is the socioeconomic structures of places themselves that exert an effect on smoking and obesity. Previous studies have examined geographic variation in smoking and obesity at various levels from the nation to neighbourhood. McLaren (2007) and Sobal and Stunkard (1989) examine effects of national differences on smoking and obesity. In the advanced nations, rates of smoking and obesity decline with income and socioeconomic status, as we have seen. But in the developing nations, the opposite is true: Rates of smoking and obesity increase with income and higher socioeconomic status (Monteiro, 2004; Willms et al., 2004). This finding fits nicely with the work of Inglehart (1989,1990, 1997) who observes that advanced nations tend to be less materialistic and less oriented towards consumption than developing nations.

Lifestyle differences which effect smoking and obesity also vary by geographic location. Regional differences in fruit and vegetable intake, as well as physical activity predict lower obesity rates in large Canadian metropolitan areas than in smaller places (Vanasse et al., 2005). A study of U.S. counties found an association between obesity and spatial structure, and that rates of obesity were higher in auto-dependent suburban areas

where individuals walked less (Ewing et al., 2003). A separate study by Ross et al. (2007) found a positive relationship between sprawl and obesity for men but not for women.

We test this proposition regarding post-industrial structures statistically, using bivariariate and partial correlations, as well as multivariate OLS regressions. Our analysis is conducted at the state level and covers all 50 US states. We examine the effects of concentrations of knowledge-based or creative workers and of higher levels of educational attainment on smoking and obesity while controlling for income as well as race and ethnicity. We also examine the effects of observed levels of social openness and diversity, testing the effects of concentrations of gay, bohemian and immigrant populations on smoking and obesity.

Our findings confirm the hypothesis. Our measures for creative and knowledge based occupations as well as for educational attainment outperform income in predicting state-level smoking and obesity. Our correlation analysis shows stronger relations for human capital, occupational and class structure and measures of openness and tolerance than for income. Our multivariate analysis shows that when we control for income, education and creative occupation variables stay significant. In the obesity multivariate regression, openness stays significant as well.

## Variables, Data, and Methods

We use a series of analytic techniques to examine the relationship of post-industrial structures and attitudes on smoking and obesity. This section outlines the major variables, data sources and methods used in those analyses. We begin with a discussion of core variables.

***Dependent Variables***

*Smoking:* This is based on the share of state population that smokes regularly. Data are from the Centers for Disease Control (CDC) Behavioral Risk Factor Surveillance System, which is based on a telephone survey, for the year 2008.

*Obesity:* This variable is based on the Body Mass Index or BMI. We use the share of population with a BMI of 30 or greater which is considered to be obese. Data are also from the CDC's Behavioral Risk Factor Surveillance System for 2008.

***Independent Variables***

We employ a range of independent variables in our analysis. The independent variables cover factors like economic output as well as income and race which the extant literature identifies as key factors in smoking and obesity. We also develop independent variables to reflect post-industrial economic structure such as human capital levels and occupational structures, and of values and attitudes that have found to be associated with those structures such as openness to diversity.

*Economic output per capita**:*** Both the research literature and the conventional wisdom suggest that smoking and obesity are associated with the level of economic development. People smoke more and are more obese poorer places, and the opposite is true in richer places. Our measure of economic output is Gross State Product per capita. The data is from U.S. Bureau of Economic Analysis for the year 2005.

**Race and Ethnicity:**

We employ two different ethnicity measures;

*African-American:* This variable is measured as the African American share of the population and the data is from the American Community Survey, US Census, for the years 2006-2008.

*Hispanic:* This variable is measured as the Hispanic or Latino share of the population, based on the American Community Survey, US Census, for the years 2006-2008.

**Post-Industrial Structure Variables:**

We employ several variables to account for post-industrial economic structures.

*Human Capital:* A host of studies have noted the shift from lower-skill industrial economies to higher-skill ones based on knowledge (Malchup 1962; Romer,1986; Drucker, 2000) and human capital (Romer, 1986; Lucas, 1988; Barro,1991; Rauch, 1993). Our variable for human capital follows convention – the share of the adult population with a bachelor's degree and above. The data for this variable is from the 2006 US Census.

*Creative Class:* Many studies have noted the related shift from an economy based on industrial work and occupations to one based on more technology-driven, knowledge-oriented creative production. Florida (2002) estimates the creative class as comprising 38 million American workers and 30 percent of all jobs. This creative class is defined as the share of the labor force who "engage in complex problem solving that involves a great deal of independent judgment and requires high levels of education or human capital" (Florida, 2002, p. 8). The occupational data is from the US Bureau of Labor Statistics for the year 2006.

*Working Class:* Traditional industrial economies are defined by higher shares of blue-collar industrial occupations. This variable reflects the share of the labor force engaged in more traditional production, extraction, installation, maintenance, repair, production, transportation and construction occupations. As above, this variable is based on BLS data for the year 2006.

**Post-Industrial Values Variables:**

As noted above, post-industrial societies are more oriented to openness and diversity. We employ two different variables to reflect Inglehart's post-materialist values, detailed below.

*Immigrant Concentration:* This variable is the share of foreign-born in relation to the total state population. The data are from the US Census for year 2006.

*Gay Index:* Inglehart (2005) notes that openness to gays and lesbians is the last frontier of openness and tolerance. Several studies (Black et al. 2000; Florida and Gates 2001; Florida 2002; Florida and Mellander, 2009) have examined the relationships between gay populations and characteristics of state and regional economies. The Gay Index variable is a measure for gay and lesbian household concentrations, expressed as a location quotient. The data is from the US Census for the year 2006.

The two openness measures are close associated with a correlation of 0.699. To avoid multicollinearity problems in the multivariate regression, we will combine them into a combined Openness Factor which we identified through factor analysis. The Gay Index and Foreign-Born variables are closely correlated (.913) with the Openness Factor. In bivariate and partial correlation analyses, we will report for the relations for all three (immigration concentration, the gay index, and the created openness measure).

***Health and Well-Being***

We also examine the relationship between smoking and obesity and a series of measure of health and well being.

*Cancer Deaths:* We employ a measure of Cancer Deaths per 100,000 people from the National Center of Health Statistics for 2006.

*Heart Disease:* This variable measures deaths from heart disease as a proportion of state population. It is also based on 2006 data from the National Center of Health Statistics.

*Cerebrovacular Deaths:* This variable measures deaths from cerebrovacular disease (e.g. hyper-tension) per 100,000 state residents. It too is based on 2006 data from the National Center for Health Statistics.

*Well-being:* We also examine the relationship between smoking and obesity and life-satisfaction or subjective well-being. The measure is based on survey data from The Gallup Organization for 2009.

Table 1 presents the descriptive statistics for these variables.

**(Table 1 about here)**

**Table 1:** Descriptive Statistics

| | **Min.** | **Max.** | **Mean** | **SD** |
|---|---|---|---|---|
| Smoking | 9.30 | 26.50 | 18.96 | 3.37 |
| Obesity | 18.50 | 32.80 | 26.09 | 3.00 |
| Human Capital | 0.10 | 0.22 | 0.17 | 0.03 |
| Creative Class | 0.22 | 0.37 | 0.29 | 0.03 |
| Working Class | 0.18 | 0.33 | 0.25 | 0.04 |
| Immigrant Concentration | 0.01 | 0.27 | 0.08 | 0.06 |

| | | | | |
|---|---|---|---|---|
| Gay Index | 0.48 | 1.42 | 0.92 | 0.22 |
| Economic Output per Capita | 32893 | 80936 | 48412 | 9105.65 |
| African-American | 0.01 | 0.37 | 0.10 | 0.09 |
| Hispanic | 0.01 | 0.44 | 0.10 | 0.10 |
| Well-Being | 59.90 | 69.40 | 65.21 | 1.81 |
| Cancer | 136.40 | 211.20 | 182.03 | 15.55 |
| Heart Disease | 133.90 | 270.90 | 195.36 | 30.49 |
| Cerebrovascular Disease | 29.80 | 58.80 | 44.43 | 6.62 |

*Note.* Min. = Minimum; Max. = Maximum; SD = Standard Deviation; GRP = Gross Regional Product. $N = 50$.

### Methods

We use a variety of methods in our analysis. We begin my mapping the geographic incidence of smoking and obesity for the fifty US states. We then employ basic bivariate correlation analysis to identity relationships between smoking and obesity and key social, demographic and economic factors. To rule out that these relations are purely driven by e.g. a general standard of living or race, we also run partial correlations, controlling for GRP per capita, African-American share of the population and Hispanic share of the population. We also use multivariate OLS regression analysis, to examine the relative importance of the post-industrial explanatory variables. We also want to examine whether or not they stay significant when employed to the more traditional variables, such as income and race.

## Findings

We begin with the analysis and findings on the geographic distribution of smoking and obesity. We then turn to a more detailed analysis of the relationship between post-industrial economic and social structures and the incidence of smoking and obesity.

### Mapping Smoking and Obesity

Figure 1 maps the incidence of smoking across the fifty U.S. states. Nationwide, 18.4 percent of the adult population are smokers, but smoking ranges from a high of 26.5 percent in West Virginia, 26 percent in Indiana, and 25.2 percent in Kentucky to 14.7 percent in New Jersey, 14.0 percent in California and only 9.3 percent in Utah.

**(Figure 1 about here)**

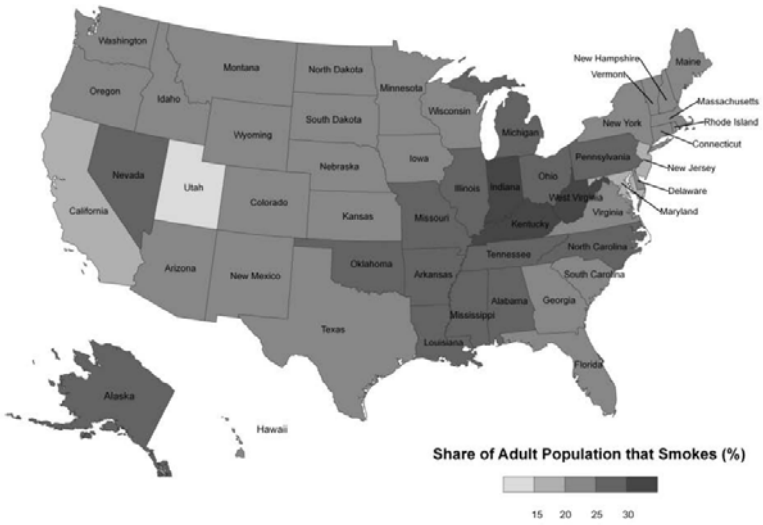


**Figure 1:** Share of Adult Population that Smokes

Figure 2 maps the incidence of obesity across the fifty states. More than a quarter, 26.7 percent, of Americans are obese according this measure, but again there is substantial variation across states, ranging from a high of 32.8 percent in Mississippi, 31.4 in Alabama, and 31.2 percent in West Virginia to a low of 21.0 percent in Connecticut, 20.9 in Massachusetts and only 18.5 in Colorado.

**(Figure 2 about here)**

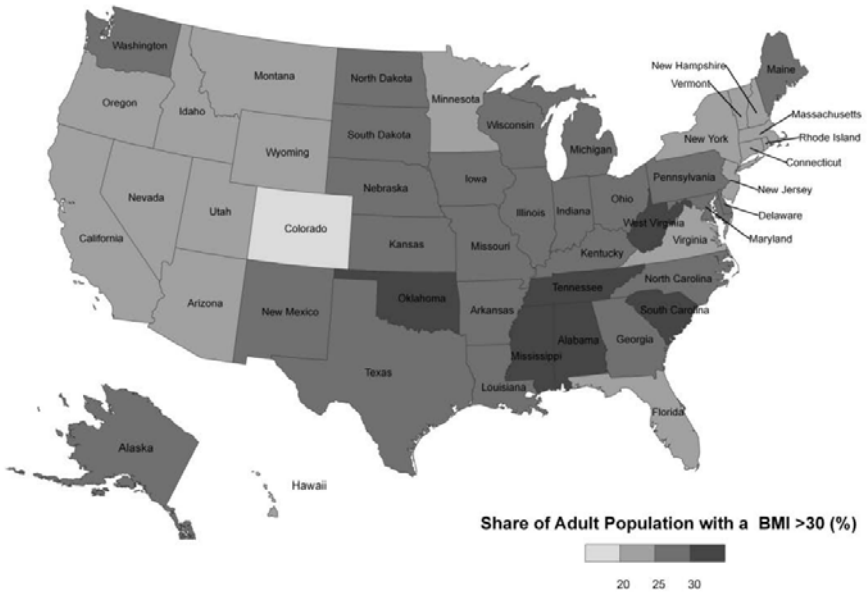


**Figure 2:** Share of Adult Population with a BMI Greater than 30

There is less variation between the states in terms of smoking rates than in terms of obesity rates. The geographic distribution of obesity generally conforms to a broad regional pattern. With a few exceptions the West Coast, Mountain West and New England states tend to have lower than average BMIs than the Plains, Bible Belt, and Great Lakes, and Mid-Atlantic states, which tends to have lower scores than the Deep South states. Smoking rates are higher than average in the Deep South. A few geographically dispersed states: New Jersey, California, Hawaii and Utah score lower than average on both indicators. Smoking and obesity are related to one another. As Table 3 (below) shows, the correlation coefficient for the two is 0.699, indicating a reasonably high association.

***Smoking and Obesity, and Well-Being***

It is well know that smoking and obesity have significantly detrimental effects on health and well-being. In the main these effects have been identified in studies of the health risks of

smoking and obesity or the economic costs of the behaviors for the national economy. Here we examine the correlations between smoking and obesity and major diseases as well as an established measure of life satisfaction or subjective well-being. Table 2 summarizes the results of a bivariate and partial correlation analysis of the relationships between smoking and obesity and these key indicators of health and well-being.

**(Table 2 about here)**

**Table 2:** Correlation Analysis Findings for Health and Well-Being

| | Bivariate | | Partial[1] | | Partial[2] | | Partial[3] | |
|---|---|---|---|---|---|---|---|---|
| | Smoking | Obesity | Smoking | Obesity | Smoking | Obesity | Smoking | Obesity |
| Cancer Deaths | .752*** | .702*** | .742*** | .700*** | .755*** | .611*** | .735*** | .659*** |
| Heart Disease Deaths | .674*** | .727*** | .646*** | .706*** | .725*** | .661*** | .656*** | .714*** |
| Cerebrovascular Deaths | .588*** | .741*** | .534*** | .694*** | .558*** | .678*** | .540*** | .707*** |
| Well-Being | -,714*** | -,598*** | -,689*** | -,556*** | -,700*** | -,519*** | -,711*** | -,591*** |

*** indicate significance at the 0.01 level
[1]Control for GDP per capita
[2]Control for African-American Population
[3]Control for Hispanic Population

Both smoking and obesity pose significant risks to health and well-being (Table 2). All correlations are strong and highly significant. There is a 0.752 correlation for smoking and 0.702 correlation for obesity with cancer death rates at the state aggregate level. We also find strong and significant relations with heart disease deaths (0.674 for smoking and 0.727 for obesity). Cerebrovascular deaths are also closely related to the state smoking shares (0.588) and even more strongly related to obesity (0.741). Both smoking and obesity is negatively related with the state level well-being (-0.714 vs. -0.598). However, we assume no causal effect between the two, but rather that there is a simultaneous relation.

Also, after we've controlled for GDP per capita and ethnicity effects in partial correlations (Table 2, column 3-6), these relations remain strong with correlations of approximately 0.530-0.750. This indicates that higher smoking and obesity rates at an

aggregated level, also is related to higher health risks in general, even if we control for GDP per capita or ethnicity.

**Correlation Analysis**

We now turn to the findings with regard to post-industrial structure. Table 3 presents the results of a straightforward correlation analysis examining the effects of variables like post-industrial structure, as well as income and race and ethnicity on smoking and obesity. We present the bivariate results first, followed by the partial correlations, where we control for GDP per capita and ethnicity.

**(Table 3 about here)**

**Table 3:** Key Findings from the Correlation Analysis

| | Bivariate | | Partial[1] | | Partial [2] | | Partial[3] | |
|---|---|---|---|---|---|---|---|---|
| **State-level Indicators** | **Smoking** | **Obesity** | **Smoking** | **Obesity** | **Smoking** | **Obesity** | **Smoking** | **Obesity** |
| Smoking | | .699*** | | .662*** | . | .696*** | | .672*** |
| Obesity | 699*** | | .662*** | | .696*** | | .672*** | |
| Human Capital | -.764*** | -.760*** | -.735*** | -.711*** | -.753*** | -.740*** | -.774*** | -.776*** |
| Creative Class | -.549*** | -.554*** | -.478*** | -.436*** | -.558*** | -.604*** | -.539*** | -.536*** |
| Working Class | .617*** | .687*** | .556*** | .588*** | .602*** | .681*** | .572*** | .630*** |
| Immigrant Concentration | -.500*** | -.511*** | -.425*** | -.401*** | -.521*** | -.593*** | -.432*** | -.416*** |
| Gay Index | -.390*** | -.465*** | -.323** | -.396*** | -.416*** | -.569*** | -.292** | -.381*** |
| Openness | -.487*** | -.534*** | -.413*** | -.442*** | -.512*** | -.636*** | -.408*** | -.456*** |
| Economic Output per Capita | -.320** | -.432*** | | | -.336** | -.496*** | -.292** | -.398*** |
| African-American | 0.212 | 0.458*** | .241 | .528*** | | | .191 | .450*** |
| Hispanic | -0.298** | -0.331** | -.267* | -.293** | -.279* | -.308** | | |

* $p < .1$; ** $p < .05$; *** $p < .01$,
[1]Control for Economic Output per Capita
[2]Control for African-American Population
[3]Control for Hispanic Population

The findings of the bivariate analysis (column 1-2) support the hypothesis that smoking and obesity are more closely associated with key elements of post-industrial transformation than with either economic output or race and ethnicity. The correlations for obesity are in general slightly stronger than those for smoking, but most of the relations are highly significant at a 0.01 level. Both smoking and obesity are significantly related to

economic output (-0.320, -0.432). In other words, the higher the economic output, the less likely the population is to smoke or be obese. Turning to race and ethnicity, we find stronger relations for obesity than for smoking, where African-American population is positive and significant (0.458), while Hispanic is negative and significant (-0.331). But the correlations for post-industrial structure variables are higher. The correlation coefficients for human capital are strong and significant (-0.764 for smoking, -0.760 for obesity), as are those for creative class occupations (-0.549 for smoking, -0.544 for obesity), The coefficients for working class share of the labor force are positive and significant (0.617 for smoking, 0.687 for obesity). Turning now to regional openness levels, the correlations are all are negative and significant, ranging from -0.390 to -0.538.

Since we would expect a close relation between economic output and the post-industrial, regional structure, we run partial correlations to control for the effects of economic output (column 3-4). When we do, we find that most of the bivariate correlations stay quite robust, and get only slightly weaker. Human capital remains highly positive and significant (-0.735 for smoking, -0.711 for obesity), and that the creative class variable does so as well (-0.478 for smoking, -0.436 for obesity). The working class variable also remains positive and significant and positive with a correlation of 0.588 for smoking and 0.602 for obesity. Also, the openness indicators stay significant, now ranging from -0.323 to -0.442.

We get the same basic pattern when we control for ethnicity (Column 5-6 – African-American population, Column 7-8 – Hispanic population). Human capital remains negative and significant with correlations ranging from -0.74 to -0.78, while the coefficients for the creative class range from -0.536 to -0.604. The coefficients for working class jobs also remain positive and significant ranging from 0.572 to 0.681. Furthermore, the openness variables continue to remain significant when we control for ethnicity. When we control for African-American share of population, the coefficients for openness strengthen, ranging from

-0.416 to -0.636). The correlation coefficients range from -0.292 to -0.456 when we control for Hispanic population.

**Regression Findings**

We ran a series of OLS regressions to further probe for the effects of post-industrial structure on smoking and obesity. The regressions include three key variables for post-industrial economic structure - human capital, creative class, and working class; a measure of post-industrial or post-materialist values – the openness factor which combines the gay index and immigrant variables; and control variables for economic output per capital and race and ethnicity. Since the human capital and creative class variables are closely correlated with one another we use one at a time, in order to avoid multicollineary problems. Furthermore, in all regressions we test for multicollinearity, to rule out variables that include the same type of information. Table 4 summarizes the results for the smoking regressions; Table 5 does the same for the obesity regressions

[Table 4 about here]

**Table 4:** Smoking Regressions

| | **Eq 1** | **VIF** | **Eq 2** | **VIF** | **Eq 3** | **VIF** |
|---|---|---|---|---|---|---|
| Constant | 33.302*** | | 32.173*** | | 7.756 | |
| | (11.247) | | (6.309) | | (1.418) | |
| Human Capital | -90.789*** | 1.654 | - | - | - | - |
| | (-6.212) | | | | | |
| Creative Class | - | - | -46.710*** | 1.503 | - | - |
| | | | (-2.764) | | | |
| Working Class | - | - | - | - | 43.260** | 2.186 |
| | | | | | (2.576) | |
| Openness | -.516 | 2.735 | -1.069 | 2.710 | -.752 | 3.265 |
| | (-1.011) | | (-1.651) | | (-1.047) | |
| Economic Output per Capita | 3.017E-5 | 1.386 | -5.993E-6 | 1.380 | -5.551E-6 | 1.401 |
| | (.748) | | (-.117) | | (-.106) | |
| African-American | -.408 | 1.280 | 8.448* | 1.061 | 5.917 | 1.167 |
| | (-.105) | | (1.883) | | (1.245) | |
| Hispanic | -4.454 | 2.178 | -.007 | 2.116 | 1.210 | 2.063 |
| | (-.949) | | (-.001) | | (.206) | |
| R2 Adj | .604 | | .357 | | .344 | |
| N | 47 | | 47 | | 47 | |

**(Table 5 about here)**

**Table 5:** Obesity Regressions

| | Eq 1 | VIF | Eq 2 | VIF | Eq 3 | VIF |
|---|---|---|---|---|---|---|
| Constant | 35.270*** | | 34.923*** | | 19.678** | |
| | (16.362) | | (10.151) | | (5.355) | |
| Human Capital | -53.727*** | 1.654 | | | | |
| | (-5.049) | | | | | |
| Creative Class | | | -28.881** | 1.503 | | |
| | | | (-2.534) | | | |
| Working Class | | | | | 27.267** | 2.186 |
| | | | | | (2.417) | |
| Openness | -.988** | 2.735 | -1.297*** | 2.710 | -1.089** | 3.265 |
| | (-2.658) | | (-2.969) | | (-2.258) | |
| Economic Output per Capita | -2.678E-5 | 1.386 | -4.698E-5 | 1.380 | -4.616E-5 | 1.401 |
| | (-.913) | | (-1.359) | | (-1.317) | |
| African-American | 10.880*** | 1.280 | 16.084*** | 1.061 | 14.472*** | 1.167 |
| | (3.864) | | (5.315) | | (4.533) | |
| Hispanic | .186 | 2.178 | 2.722 | 2.116 | 3.446 | 2.063 |
| | (.055) | | (.685) | | (.873) | |
| R2 Adj | .721 | | .610 | | .606 | |
| N | 47 | | 47 | | 47 | |

The regression results indicate that the post-industrial variables are significantly associated with both smoking and obesity. The human capital and creative class variables are significantly and negatively associated with both, while the working class variable is significantly and positively associated with smoking and obesity. The R2 Adjusted values are higher for the obesity models (R2 Adj = 0.601-0.721) than for the smoking models (R2 Adj = 0.344-0.604). The regressions also reveal that the human capital variable explains more of smoking and obesity than the creative class and working class variables. This is particularly the case for smoking where the R2 Adj value almost doubles when the human capital variable is added.

We now turn to the more specific results from the smoking and obesity regressions in turn. Starting with the results for smoking (Table 4): As Eq 1 shows, the human capital model generates a R2 Adj value of 0.604. When we run the regression separately, using just human capital to explain smoking it generates at R2Adj of 0.576, suggesting that roughly 60 percent of the variation is explained by this variable. We find no significant relationship to

GDP per capita, ethnicity and openness in this model. Now to the creative class model: While the R2 Adj value is lower (0.357), the creative class variable is significant at the 0.01 level. GDP per capita, ethnicity and openness remain insignificant in this model. In the working class model (Eq 3), the R2 Adj is about the same (0.340) and this variable is significant (at the 0.05 level). Again, GDP per capita, ethnicity, and openness are not significant. In all three regressions, the VIF values are at an acceptable level, indicating that there are no multicollienarity problems in any of the three regressions.

The obesity models generate higher R2 Adj variables across the board (Table 5). In the model for human capital, the R2Adj is 0.721, and human capital is significant at the 0.01 level. Our proxy measure for post-industrial values is negative and significant. The African-American variable is positive and significant in this model. The variables for economic output per capita and the Hispanic variables are insignificant. Turning next to the creative class model (Eq 2): the R2 Adj is 0.610, and the creative class variable is significant at the 0.05 level. The openness variable is again negative and significant at the 0.01 level. The African-American is also again positive and significant at the 0.01 level. The variables for GDP per capita as well as Hispanic remain insignificant. In the working class model (Eq 3), the R2 Adj is 0.606. The working class variable is significant and positive: In other words, states with higher shares of working class jobs have higher rates of obesity. The openness variables is negative and significant at the 0.05 level. The African-American variable is positive and significant at the 0.01 level. Once again, the variables for economic output per capita and Hispanic are insignificant. The relatively low VIF values indicate that there were no multicollinearity problems in our estimations.

When we compare the smoking and obesity models, it is clear that post-industrial factors do better and explaining obesity than smoking. The human capital variable provides significant explanatory power in both the obesity and smoking models, performing slightly

better in the former, generating an R2 Adj of 0.721 compared 0.604. The creative class variable performs significantly better in explaining obesity than smoking, where the R2 Adj is 0.610 compared to 0.357. The same is true of the working class variable which generates an R2 Adj 0.606 in the obesity model compared to 0.340 in the smoking model.

## Conclusion

Our research has examined the effects of post-industrial structures and values on smoking and obesity. Previous research has found that factors such as income and race and ethnicity play a strong role in explaining smoking and obesity. We hypothesized that post-industrial structure variables – namely human capital and knowledge/creative class work versus blue-collar working class jobs – along with post-industrial values which favor openness would better explain state level variation in smoking and obesity that conventional variables of income or economic output per capita and race and ethnicity.

Our findings confirm the hypothesis. Our post-industrial structures variables – human capital, the creative class and the working class – outperform economic output across the board in explaining state-level variation in smoking and obesity. Of these measures, the human capital variables generates the strongest results, though the results for the creative class and working class variables are significant in each and every model. Simply put, states which have more of their workforce in creative jobs, as well as more highly educated populations, have lower rates of smoking and obesity than those in which greater shares of the workforce engage in blue-collar work. The results for our post-industrial values variables are more mixed. Our combined openness factor is significant in explaining obesity, but not smoking. In addition, the race variables (African-American) remains significant in the obesity models. Generally speaking, post-industrial factors do better in explaining obesity than smoking though they are significant in explaining both. In strong contrast to previous

research, our measure of income or economic output per capita was not significant in any of our analysis. Once post-industrial factors are put into the mix, income effects no longer matter for smoking and obesity.

Our results lead us to conclude the effects of the transition to post-industrial socioeconomic structures on smoking and obesity are profound. It appears that once individuals are embedded in these kinds of structures their propensities smoke and to over-eat decrease significantly. We suggested several mechanisms for this effect. Clearly, more highly educated individuals are better positioned to both access information and to comprehend the risks of smoking and obesity. It may also be that creative/ knowledge-based occupations select for more physically fit individuals. Certainly, social and professional norms have shifted away from unhealthy behavior, in particular smoking at work and a growing number of companies provide access to workout facilities and some even provide incentives such as lower health care payments for physically-fit employees. It may also be that knowledge-based and creative work orients a greater number of individuals toward active pursuits and physical fitness. Studies of creative work have found that engaging in physical activities tends to clear the mind and reset concentration leading to more productive efforts.

We believe our research points to the important role played by new post-industrial work structures in leading to lower levels of smoking and obesity and healthier lifestyles. It is not just income or race and ethnicity that effect obesity and smoking but socioeconomic structures we are part of and especially the kinds of work we engage in. We encourage future research t probe the effects of post-industrial structures on smoking and obesity as well as other measures of health and well-being.

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